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CENTROLENID FROGS FROM PERÚ

By

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Although numerous species of the small frogs of the genus *Centrolenella* are known from Colombia and Ecuador, only one species has been reported from Perú. Boulenger (1918) named *Hylella ocellata* from Huancabamba, Departamento Pasco. Taylor and Cochran (1953) suggested that Boulenger's species was a centrolenid, and Goin (1964) placed *ocellata* in *Centrolenella,* an assignment verified by Lynch and Duellman (1973), who listed additional specimens from Departamento Ayacucho.

Field work in Perú in February 1975 resulted in the acquisition of an additional specimen of *Centrolenella ocellata,* in addition to series of two species previously known only from Ecuador, and two other unnamed species. These specimens, together with eight individuals collected earlier, form the basis of this report. The terminology and methodology used herein is that of Lynch and Duellman (1973).

Field work was made possible by grants from the National Geographic Society and the National Science Foundation (GB 42481); I am grateful to my field companions Dana K. Duellman, John E. Simmons, and Linda Trueb for their patience in searching for elusive centrolenids. Thanks are due to Alice G. C. Grandison, British Museum (Natural History) (BMNH) and Douglas A. Rossman, Louisiana State University Museum of Zoology (LSU) for the privilege of examining specimens in their care. Specimens in the Museum of Natural History at the University of Kansas are designated KU. Representatives of all species are illustrated in Figure 1.

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Accounts of Species

Centrolenella munozorum Lynch and Duellman

Centrolenella munozorum Lynch and Duellman, 1973:40 [Holotype.—KU 118054 from Santa Cecilia, Provincia Napo, Ecuador].

Diagnosis.—(1) Prevomerine teeth absent; (2) bones white; (3) parietal peritoneum clear; visceral peritoneum white; (4) color in life pale green with diffuse yellow spots; in preservative creamy white with minute reddish brown flecks; (5) webbing between outer fingers III 2⁺-2 IV; (6) webbing on foot I 1-1¾ II 1½-1½ III 1½-2¼ IV 2¼-1½ V; (7) snout round in dorsal and lateral profiles; (8) dorsal skin shagreened; (9) arms and legs lacking dermal folds; (10) humeral spine absent in males; (11) tympanum concealed, strongly directed dorsolaterally.

Centrolenella munozorum differs from other Peruvian species by having the heart visible through the ventral body wall and by being white in preservative. The only other species on the eastern slopes of the Andes having these characteristics, *C. pellucida*, differs by having ulnar, tarsal, and anal folds.

Distribution.—This species is known from three localities in Perú, two in cloud forest on the eastern front of the Andes and one in lowland tropical rainforest. The species has a known elevational range of 200-1840 m. The southernmost locality (Río Cosñipata, Departamento Cuzco) is approximately 1600 kilometers (airline) south-southeast of the Ecuadorian localities on the Río Aguarico.

Remarks.—The specimens from the Río Piene and Río Cosñipata have slightly less webbing on the hands and feet than do those from Ecuador. Also, the Peruvian frogs are slightly larger than those from Ecuador. The snout-vent length in eight Peruvian males is 22.7-25.7 ($\bar{x} = 24.1$) mm and in five Ecuadorian males, 18.8-20.5 ($\bar{x} = 19.7$) mm. One female from Ecuador has a snout-vent length of 20.7 mm, whereas two Peruvian females have snout-vent lengths of 23.3 and 24.4 mm. The coloration in life is the same in Ecuadorian and Peruvian frogs. Although the differences in size and in the amount of webbing between the two samples are of a magnitude usually exhibited by different species of *Centrolenella*, the enormous distance between the samples and the absence of other structural or color differences are suggestive of possible clinal variation in size and amount of webbing.

The specimens from the Río Piene and Río Cosñipata were found in February 1975. Males were calling from the upper and lower surfaces of herbaceous leaves up to 2 m above small rivulets. At the Río Piene one male was calling adjacent to a clutch of eggs on the underside of a leaf; the eggs had clear jelly and pale green yolks.

At the Río Cosñipata *C. munozorum* was found with *C. ocellata*, *C. spiculata*, and *C. truebae*, and at the Río Piene *C. munozorum* occurred with *C. siren*.

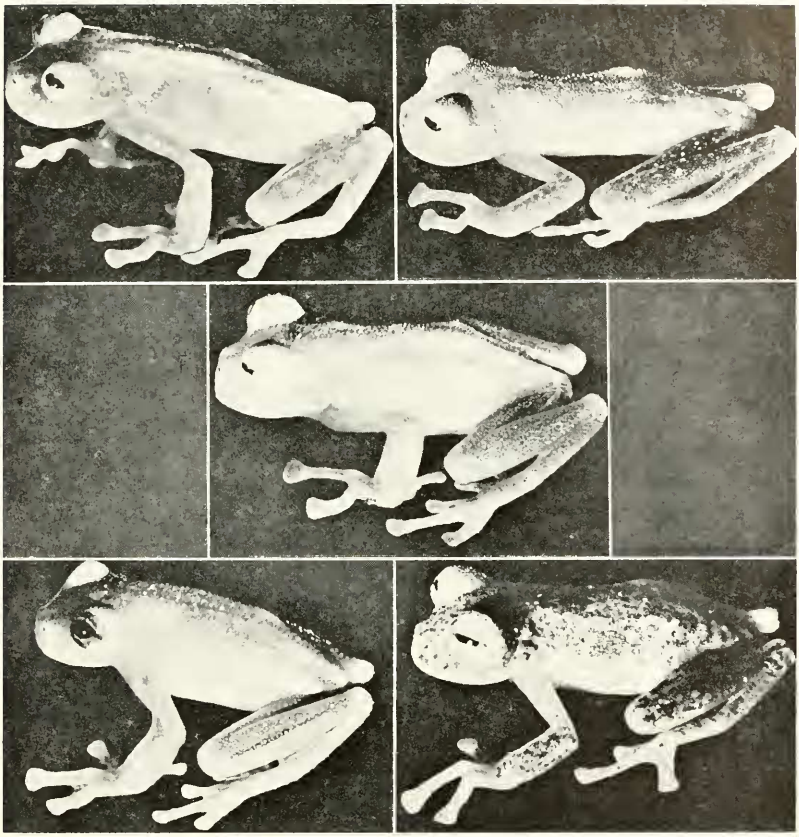

FIG. 1.—Upper left: *Centrolenella munozorum*, KU 162248, ♀, 24.4 mm. Upper right: *C. ocellata*, KU 162262, ♂, 25.4 mm. Center: *C. siren*, KU 162263, ♂, 22.8 mm. Lower left: *C. spiculata*, KU 162283, ♂, 21.7 mm. Lower right: *C. truebae*, KU 162268, ♂, 23.6 mm.

Centrolenella ocellata (Boulenger)

Hylella ocellata Boulenger, 1918:433 [Holotype.—BMNH 1912.11.1.19 from Huancabamba, Departamento Pasco, Perú].
Cochranella ocellata—Taylor and Cochran, 1953:1628.
Centrolenella ocellata—Goin, 1964:6.

Diagnosis.—(1) Prevomerine teeth absent; (2) bones green; (3) parietal peritoneum white; visceral peritoneum clear; (4) color in life dark green with pale bluish white ocelli; in preservative, lavender with cream ocelli; (5) webbing between outer fingers III 3-2¾ IV; (6) webbing on foot I 2-2½ II 2-1½ III 1½-3 IV 3 -2 V; (7) snout round in dorsal and lateral profiles; (8) dorsal skin shagreened; (9) arms and legs lacking dermal folds; (10) humeral spine absent in males; (11) tympanum entirely visible, directed dorsolaterally with slight posterior inclination.

Centrolenella ocellata differs from other Peruvian centrolenids by having moderately large dark-edged pale spots and no dark flecks on the dorsum and only basal webbing between the outer fingers. It superficially resembles the Ecuadorian *C. cochranae,* which has less webbing between the outer fingers, a truncate snout and much smaller ocelli on the dorsum.

Distribution.—This species is known from three localities at elevations of 1630-1700 m along the Cordillera Oriental in central and southern Perú. Two localities, Río Cosñipata and Huanhuachayocc are in cloud forest on the eastern front of the Andes, whereas Huancabamba is in a north-south valley (Amazonian drainage).

Remarks.—The holotype of *C. ocellata* (BMNH 1912.11.19) is a female having a snout-vent length of 29 mm; the outer finger is nearly one-half webbed. Three additional specimens are males having snout-vent lengths of 21.0, 24.5, and 25.1 mm. In each the outer finger is about one-fourth webbed. The specimen from the Río Cosñipata was green with small bluish white flecks. The margin of the upper lip was creamy white. The heart was not visible, and the iris was grayish white with fine black reticulations.

At the Río Cosñipata one male was perched on a herb in cloud forest on the night of 10 February 1975. Three other species of centrolenids (*C. munozorum, C. spiculata,* and *C. truebae*) were found at the same locality.

Centrolenella siren Lynch and Duellman

Centrolenella siren Lynch and Duellman, 1973:54 [Holotype.—KU 146610 from the Río Salado, Provincia Napo, Ecuador].

Diagnosis.—(1) Prevomerine teeth absent; (2) bones green; (3) parietal peritoneum white; visceral peritoneum clear; (4) color in life green with white flecks; in preservative, lavender with creamy white flecks; (5) webbing between outer fingers III 3-2½ IV; (5) webbing on foot I 2-2½ II 2-2¾ III 1½-3 IV 3-2 V; (7) snout truncate in dorsal and lateral profiles; (8) dorsal skin shagreened; (9) arms and legs lacking dermal folds; (10) humeral spine absent in males; (11) lower two-thirds of tympanum visible, directed posterolaterally, inclined dorsally.

This small species with minute pale flecks differs from all other Peruvian species principally in coloration. The only other Peruvian species with discrete pale dorsal spots is *C. ocellata,* which has much larger spots, broader discs on the fingers, and a round snout. Two species, *C. flavomaculata* and *C. midas,* occurring on the Amazonian slopes of Ecuador are like *C. siren* in coloration, but both have much more webbing between the fingers.

Distribution.—*Centrolenella siren* is known from several localities at elevations of 1400-1740 m on the Amazonian slopes of Ecuador and from the Río Piene at an elevation of 1840 m on the Amazonian slopes of Departamento Ayacucho, Perú.

Remarks.—The Peruvian specimens include four adult males and one juvenile. Ecuadorian males have snout-vent lengths of 19.8-22.0 mm ($\bar{x} = 20.8$, $N = 14$); those from Perú are 20.8-23.5 mm ($\bar{x} = 22.2$, $N = 4$) in length. The only other noticeable difference is that Ecuadorian specimens have yellow flecks instead of white, as in the Peruvian frogs. The specimens from the Río Piene had a white margin to the upper lip; the vocal sac was green, and the iris was silvery white with black reticulations.

At the Río Piene males of *C. siren* were calling at night from dense herbaceous growth above a low-gradient stream. The short call consists of three quickly repeated notes and is distinct from the higher-pitched single note produced by *C. munozorum,* which was calling at the same time.

Centrolenella spiculata new species

Holotype.—KU 162284, an adult male, 21.8 mm, from the Río Cosñipata, 4 kilometers southwest of Santa Isabel, Departamento Cuzco, Perú, 1700 m, obtained on 10 February 1975 by Linda Trueb.

Paratopotype.—KU 162283, collected with the holotype.

Diagnosis.—(1) Prevomerine teeth 1-4; (2) bones green; (3) parietal peritoneum white; visceral peritoneum clear; (4) color in life dark green; in preservative, dark lavender; (5) webbing between outer fingers III 2-1 IV; (6) webbing on foot I 1-1½ II 1-1¾ III 1-2 IV 2-1 V; (7) snout round in dorsal and lateral profiles; (8) dorsal skin bearing many minute spicules; (9) arms and legs lacking dermal folds; (10) humeral spine absent in males; (11) lower three-fourths of tympanum visible, directed dorsolaterally, slightly inclined posteriorly.

The combination of a uniformly dark green, finely spiculate dorsum, extensively webbed fingers with large discs, and the absence of humeral spines in males readily distinguishes *C. spiculata* from all other Andean species of *Centrolenella.* The Ecuadorian *C. megacheira* also has spiculate dorsal skin but differs from *C. spiculata* in being much larger and by having little webbing between the fingers and black spots on the dorsum.

Description.—Adults moderately small; snout-vent length 21.7-22.8 mm ($\bar{x} = 22.2$, $N = 7$) in males; females unknown. Head slightly wider than body; width of head 35.5-36.9% ($\bar{x} = 36.2$, $N = 7$) of snout-vent length; snout very short, round in dorsal and lateral profiles, canthus round; loreal region barely concave; lips not flared; nostrils nearly terminal on snout, not protuberant; internarial area not depressed. Eye moderately large, directed anterolaterally. Supratympanic fold barely evident; lower three-fourths of tympanum visible, directed dorsolaterally, slightly inclined posteriorly. Prevomerine dentigerous processes short, transverse between choanae, each bearing 0-2 teeth; choanae small, ovoid;

tongue broadly cordiform, shallowly notched posteriorly, barely free behind; vocal slits extending from midlateral base of tongue towards angles of jaws.

Humeral spine absent, forearm robust; ulnar fold and tubercles absent; fingers short with lateral fringes; first finger slightly longer than second; fourth finger slightly shorter than third; webbing vestigial between first and second fingers; webbing formula for other fingers II 1½-(2½-3) III (1½-2)-(1-1½) IV; discs large, broad, truncate; subarticular tubercles large, subconical, simple; supernumerary tubercles absent; palmar tubercle low, ovoid; nuptial excrescences absent. Hind limbs moderately robust; length of tibia 55.2-59.9% ($\bar{x} = 57.0$, $N = 7$) of snout-vent length; tarsal folds and tubercles absent; inner metatarsal tubercle small, elongate; outer metatarsal tubercle absent; subarticular tubercles small, round; supernumerary tubercles absent; feet about three-fourths webbed; webbing formula I 1-1½ II 1-(1½-2) III (1-1½)-(1-2) IV (1½-2)-1 V; discs on toes smaller than those on fingers, truncate.

Skin on dorsal surfaces smooth, with minute white spicules on dorsum of body and dorsal and lateral surfaces of head; skin on belly and proximal surfaces of thighs areolate; other surfaces smooth; anal opening directed posteriorly at upper level of thighs; anal tubercles and folds absent.

Color in preservative: dorsal surfaces, exclusive of fingers and toes, uniformly dark lavender; other surfaces cream.

Color in life: dorsum dark green; tips of digits yellowish green; margin of upper lip greenish white; parietal peritoneum white; visceral peritoneum clear; heart not visible; bones green; iris dull bronze with fine black reticulations.

Distribution.—*Centrolenella spiculata* is known from the type locality at 1700 m and from San José, Río Santa Rosa, 1000 m, Departamento Ayacucho, Perú.

Remarks.—At the Río Cosñipata, two individuals were calling at night from the upper sides of leaves of herbs adjacent to a small stream. The call is a short "peep." The type locality is between kilometer markings 150 and 151 on the road from Paucartambo to Pilcopata. In this area, which supports cloud forest, many streams cascade down steep slopes on the north side of the Río Cosñipata.

Etymology.—The specific name is derived from the Latin *spiculum*, meaning a small, sharp structure.

Centrolenella truebae new species

Holotype.—KU 162268, an adult male, 23.6 mm, from Río Cosñipata, 4 kilometers southwest of Santa Isabel, Departamento Cuzco, Perú, 1700 m, one of a series collected on 10-11 February 1975 by William E. Duellman, John E. Simmons, and Linda Trueb.

Paratopotypes.—KU 162269-81, collected with the holotype.

Diagnosis.—(1) Prevomerine teeth absent; (2) bones green;

(3) parietal peritoneum white; visceral peritoneum clear; (4) color in life green with greenish black flecks and creamy white spots; in preservative, lavender with black flecks and small white spots; (5) webbing between outer fingers III 3-3 IV; (6) webbing on foot I 2-2½ II 1¾-3 III 2-3 IV 3-2 V; (7) snout round in dorsal view, truncate in lateral profile; (8) dorsal skin shagreened with small spinules; (9) arms and legs lacking dermal folds; (10) humeral spine absent in male; (11) lower three-fourths of tympanum visible, directed posterolaterally with slight dorsal inclination.

Centrolenella truebae differs from other species on the Amazonian slopes, except *C. pipilata* and *ocellata*, by having dark flecks and pale spots on the dorsum. *Centrolenella ocellata* has cream-centered ocelli on the dorsum. *Centrolenella pipilata* has dermal fringes on the outer edges of the hands, forearms, and feet, and males have a humeral spine. Other species on the Amazonian slopes are either uniform green or are green with yellow flecks or diffuse spots.

Description.—Adults moderately large; snout-vent length 22.6-24.8 mm ($\bar{x}$ = 23.3, N = 13) in males, 24.8 mm in one female. Head noticeably wider than body; width of head 35.8-37.2% ($\bar{x}$ = 36.3, N = 14) of snout-vent length; snout short, round in dorsal view, truncate in lateral profile; canthus round; loreal region barely concave; lips not flared; nostrils three-fourths distance from eye to tip of snout, protuberant laterally; internarial area slightly depressed. Eye large, protuberant, directed more anteriorly than laterally. Supratympanic fold weak; lower three-fourths of tympanum visible, directed posterodorsally with a slight dorsal inclination. Prevomerine dentigerous processes and teeth absent; choanae moderately large, ovoid; tongue broadly cordiform, shallowly notched behind, barely free posteriorly; vocal slits extending from midlateral base of tongue to angles of jaws.

Humeral spine absent; ulnar fold and tubercles absent; first and second fingers equal in length; fourth finger somewhat shorter than third; lateral fringes present on fingers; webbing absent between first, second, and third fingers; webbing formula for outer fingers III 3-3 IV; discs broad, rounded; subarticular tubercles moderately large, flattened, simple; supernumerary tubercles minute; present on proximal segments of digits; palmar tubercle moderately large, ovoid; nuptial excrescences absent. Hind limbs slender; length of tibia 55.1-60.0% ($\bar{x}$ = 57.7, N = 14) of snout-vent length; tarsal folds and tubercles absent; inner metatarsal tubercle small, flattened, elliptical; outer metatarsal tubercle small, low ovoid, subarticular tubercles small, round; supernumerary tubercles absent; toes about one-half webbed; webbing formula I 2-(2¼-3) II (1⁺-2)-(2½-3) III (1½-2)-(3 -3) IV (2½-3)-(1½-2) V; discs round, slightly smaller than those on fingers.

Skin on dorsal surfaces of head and body smooth with small

spicules most numerous on side of head posterior to eye; skin on belly and posteroventral surfaces of thighs granular; other surfaces smooth; anal opening directed posteriorly at upper level of thighs; anal tubercles and folds absent.

Color in preservative: dorsal surfaces of head, body, forearms, thighs, shanks, and feet, exclusive of toes 1-3 and distal parts of toes 4-5 pale lavender with many dark lavender flecks and a few small cream spots; other surfaces, including margin of upper lip and sharply demarcated flanks, cream.

Color in life: dorsal surfaces green with greenish black flecks and small creamy white spots; tips of digits yellowish green; margin of upper lip and axilla cream; chest white; heart not visible; bones green; iris pale gold with black reticulations.

Distribution.—This species is known only from the type locality in cloud forest on the Amazonian front of the Andes in southern Perú.

Remarks.—Individuals were perched on and calling from the upper sides of ferns along a dripping cliff at night. The call is a series of short cricket-like chirps. See the account of *C. spiculata* for a description of the type locality.

Etymology.—The species is named for Linda Trueb who first traced the call to this *Centrolenella* and whose efforts in Perú and elsewhere in South America have resulted in many specimens of centrolenid frogs.

Discussion

Lynch and Duellman (1973) commented on the association of Ecuadorian species of *Centrolenella* with the species groups defined by Savage (1967). Two general groups of *Centrolenella* are readily recognized. The *fleischmanni* group, characterized by white bones, colorless parietal peritoneum, and a white ground color in preservative, is represented in Perú solely by *C. munozorum*. The other four species known from Perú belong to the *prosoblepon* group, characterized by green bones, white parietal peritoneum, and a lavender ground color in preservative. Lynch and Duellman (1973) associated *C. siren* with *C. audax, cochranae, flavopunctata, midas*, and *prosoblepon*, and defined another assemblage consisting of *C. buckleyi, grandisonae, giffithsi, megacheira, peristicta*, and *pipilata*. Three Peruvian species, *C. ocellata, spiculata*, and *truebae*, fit into the latter assemblage. As defined by Lynch and Duellman, the assemblages are only loose phenetic groupings, because knowledge of the systematics of South American centrolenids is still too fragmentary to permit a phylogenetic synthesis.

With the exception of the specimen of *C. munozorum* from Finca Panagua at 200 m, all specimens of Peruvian *Centrolenella* come from localities between elevations of 1000-1840 m on the

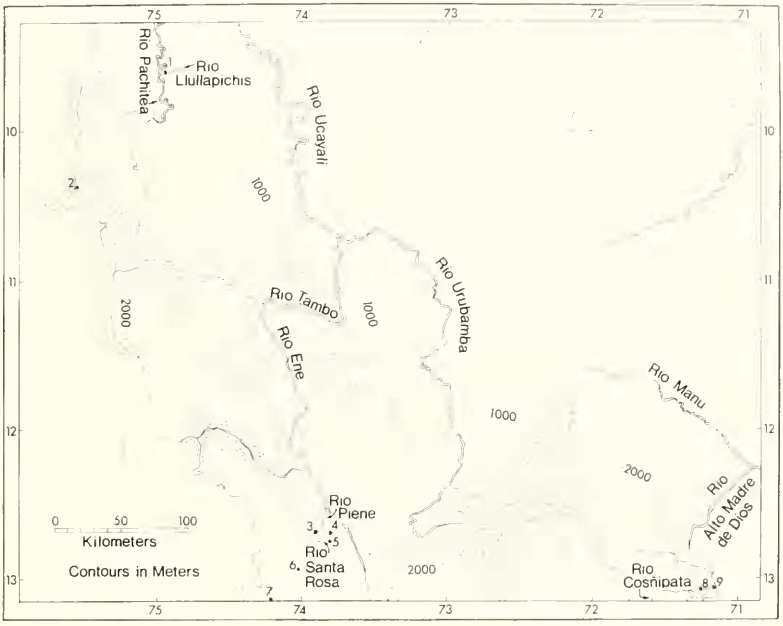

FIG. 2.—Map of east-central Perú showing localities mentioned in text: 1. Finca Panagua, 2. Huancabamba, 3 Tutumbaro, 4. San José, 5. Huanhuachayocc, 6. Tambo, 7. Ayacucho, 8. Santa Isabel, 9. Pilcopata. With the exception of those pertinent to the text, only the major rivers are shown. Based on Mapa Físico Político del Perú, 1:1,000,000, Instituto Geográfico Militar, Lima, 1973.

Amazonian slopes of the Cordillera Oriental of the Andes (Fig. 2). According to Tosi's (1960) application of Holdridge's Life Zone classification, the montane localities where centrolenids were found in Ayacucho and Cuzco are located in very humid lower montane forest and very humid subtropical forest, respectively. Huancabamba is located in humid subtropical forest, and Finca Panguana is in humid tropical forest.

The present summary of Peruvian centrolenids can be considered as nothing more than a first step on a long stairway winding through the extensive lowland and montane forests of Amazonian Perú before ascending to a plateau of knowledge comparable with that of Central American centrolenids. I suspect that several species now known from Ecuador will be found in Perú and that many species await discovery.

KEY TO PERUVIAN SPECIES OF *Centrolenella*

1. Dorsum in life pale green with diffuse yellow spots, in preservative creamy white; visceral peritoneum white; heart visible; bones white ..... *C. munozorum*

Dorsum in life dark green with or without pale or dark flecks, in preservative lavender; visceral peritoneum clear; heart not visible; bones green 2

2. Dorsal pattern consisting of many greenish black (dark purple in preservative) flecks and a few cream spots ..... *C. truebae*

Dorsum uniform green or marked with pale spots or flecks 3

3. Dorsum uniform green ..... *C. spiculata*

Dorsum with pale flecks or spots 4

4. Dorsal flecks minute; snout truncate ..... *C. siren*

Dorsal spots larger, bordered by dark pigment; snout round ..... *C. ocellata*

Resumen

La fauna de sapos centrolénidos del Perú conocida hasta ahora está compuesta por cinco especies. Dos de ellas son descritas aquí como nuevas: *Centrolenella spiculata* y *C. truebae*, las cuales provienen del Río Cosñipata en el Departamento del Cuzco; la primera también se encuentra en el Río Santa Rosa en el Departamento de Ayacucho.

De las otras especies, *Centrolenella ocellata* (Boulenger), descrita para Huancabamba, Departamento de Pasco, también se la encuentra en las laderas Amazónicas, en su extensión hasta el Río Cosñipata. Otras dos especies, *C. munozorum* y *C. siren*, conocidas previamente sólo para el Ecuador, extienden su rango hasta el Perú. *Centrolenella munozorum* se encuentra en el Río Llullapichis (Huánuco), Río Cosñipata (Cuzco), y Río Piene (Ayacucho), mientras *C. siren* se encuentra en el Río Piene.

Centrolenella munozorum es un miembro del grupo *fleischmanni;* mientras que las restantes especies peruanas pertenecen al grupo *prosoblepon*. Todas las especies peruanas se encuentran a lo largo de arroyos en selvas húmedas tropicales y subtropicales, ambientes que probablemente albergan a varias otras especies de *Centrolenella* que todavía permanecen sin ser descritas.

Specimens Examined

Only Peruvian specimens are listed; for Ecuadorian specimens see Lynch and Duellman (1973).

Centrolenella munozorum.—PERÚ: *Ayacucho:* Tutumbaro, Río Piene, 1840 m, KU 162251-57, 162258 (cleared and stained), 162259-60 (eggs), 162261 (tadpoles). *Cuzco:* Río Cosñipata, 4 km SW Santa Isabel, 1700 m, KU 162248-49. *Huánuco:* Finca Panguana, Río Llullapichis, 4-5 km upstream from Río Pachitea, 200 m, KU 154749.

Centrolenella ocellata.—PERÚ: *Ayacucho:* Huanhuachayocc on Tambo-Valle de Apurimac trail, 1630 m, LSU 25989-90. *Cuzco:* Río Cosñipata, 4 km SW Santa Isabel, 1700 m, KU 162262. *Pasco:* Huancabamba, 1700 m, BMNH 1912.11.1.19.

Centrolenella siren.—PERÚ: *Ayacucho:* Tutumbaro, Río Pienc, 1840 m, KU 162263-67.

Centrolenella spiculata.—PERÚ: *Ayacucho:* San José, Río Santa Rosa, 1000 m, LSU 25978-82. *Cuzco:* Río Cosñipata, 4 km SW Santa Isabel, 1700 m, KU 162283-84.

Centrolenella truebae.—PERÚ: *Cuzco:* Río Cosñipata, 4 km SW Santa Isabel, 1700 m, KU 162268-81, 162282 (cleared and stained).

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